WE CLAIM:

1. A current impedance apparatus for using a time-varying electrical current in a conductor, comprising

an induction choke generally configured for enveloping a portion of said conductor such that with - said choke positioned in enveloping relation about said portion of said piping structure, and with

a device electrically connected to said conductor between one side of said choke and another side of said choke,

a voltage potential is developed on the conductor on each side of said choke when a time-varying electrical current is transmitted through and along said portion of said conductor and such that a portion of said current travels through said device electrically connected to said conductor on each side of said choke.

2. A current impedance apparatus in accordance with claim 1, wherein said induction choke is unpowered.

3. A current impedance apparatus in accordance with claim 1, wherein said choke is generally cylindrical shaped with a generally cylindrical shaped void formed therethrough, said void being adapted to receive said portion of said piping structure therein.

4. A current impedance apparatus in accordance with claim 1, further comprising an insulating shell that substantially covers the surfaces of said induction choke.

5. A current impedance apparatus in accordance with claim 3, wherein said insulating shell comprises a composite material comprising a cloth and an epoxy resin.

6. A current impedance apparatus in accordance with claim 4, wherein said cloth comprises fiberglass.

7. A current impedance apparatus in accordance with claim 4, wherein said cloth comprises kevlar.

8. A current impedance apparatus in accordance with claim 3, wherein said insulating shell comprises a hard, abrasion resistant, and corrosion resistant material.

9. A current impedance apparatus in accordance with claim 1, wherein said induction choke is adapted to function without being powered by an electrical connection due to its magnetic and geometric properties.

10. A current impedance apparatus in accordance with claim 1, wherein said induction choke comprises a ferromagnetic material.

11. A current impedance apparatus in accordance with claim 1, wherein said induction choke comprises a material selected from a group consisting of low frequency transformer core alloys such as Permalloy, Supermalloy, and high-frequency transformer and choke materials such as ferrites.

12. A current impedance apparatus with claim 1, wherein said choke has a relative permeability in the range of 1,000-150,000.

13. A current impedance apparatus with claim 1, wherein said conductor comprises the production tubing in a petroleum well and the induction choke is configured for concentric positioning around a portion of the tubing.

14. A method of powering a device electrically connected to an elongated conductor comprising the steps of:

positioning an induction choke in concentric relation about a portion of the conductor;
applying a time-varying electrical current to the conductor on one side of the induction choke;
developing a voltage potential on each side of the induction choke when said time-varying electrical current is applied;
using the voltage potential to power a device.

15. A system for defining an electrical circuit, comprising:

a piping structure comprising a first end, a second end, and an electrically conductive portion extending from said first end to said second end;

a source of time-varying current electrically connected to said electrically conductive portion of said piping structure at a location along said first end;

an induction choke located about a portion of said electrically conductive portion of said piping structure;

a device comprising two terminals, said device terminals each being electrically connected to said electrically conductive portion of said piping structure such that said choke is located along said piping structure between said electrical connection locations for said device terminals; and

an electrical return electrically connecting between said electrically conductive portion of said piping structure along said second end and said source to complete said electrical circuit, such that said electrical connection for one of said device terminals is between said choke and said electrical connection location along said piping structure for said electrical return.

16. A system in accordance with claim 15, wherein said choke is located along said second end.

17. A system in accordance with claim 15, wherein said first end is near the surface and said second end is downhole in a borehole.

18. A system in accordance with claim 15, further comprising:

a second induction choke located about a portion of said piping structure along said first end, such that said source is connected to said piping structure between said chokes.

19. A system in accordance with claim 15, wherein said choke is located along said first end.

20. A system in accordance with claim 17, wherein said first end is near the surface and said second end is downhole in a borehole.

21. A system in accordance with claim 17, further comprising:

a second induction choke located about a portion of said piping structure along said second end.

22. A system in accordance with claim 15, further comprising a plurality of induction chokes distributed within at least one branch of a well, wherein at least some of said plurality of induction chokes are adapted to provide power to an additional device associated therewith using a voltage potential developed across each of said at least some of said plurality of induction chokes.

23. A system in accordance with claim 15, further comprising a plurality of induction chokes distributed along said piping structure, wherein at least some of said plurality of induction chokes are adapted to provide power to an additional device associated therewith using a voltage potential developed across each of said at least some of said plurality of induction chokes.

24. A system in accordance with claim 15, further comprising: an additional induction choke that does not have an additional device associated therewith, wherein

said additional choke is adapted to route current to other portions of said piping structure.

25. A system in accordance with claim 15, wherein said induction choke comprises a ferromagnetic material.

26. A system in accordance with claim 15, wherein said induction choke comprises a material selected from a group consisting of low frequency transformer core alloys such as Permalloy, Supermalloy, and high-frequency transformer and choke materials such as ferrites.

27. A system in accordance with claim 15, wherein said induction choke is not powered.

28. A system in accordance with claim 15, wherein said induction choke comprises an insulating shell that substantially covers the surfaces of said induction choke.

29. A system in accordance with claim 15, wherein said induction choke is electrically insulated from said piping structure.

30. A system in accordance with claim 15, wherein said induction choke has a generally toroidal shape and is generally concentric about said piping structure such that a voltage potential is developed across said choke when a time-varying electrical current is transmitted through and along said portion of said piping structure where said choke is located and such that a portion of said current travels through said device.

31. A system in accordance with claim 28, wherein said induction choke is a generally cylindrical body having a bore formed therethrough, said bore being adapted to receive said piping structure.

32. A system in accordance with claim 15, wherein the geometry, material properties, and size of said induction choke, and the frequency of a time-varying current output from said source are adapted to provide communications and power to said device using said electrical circuit.

33. A system in accordance with claim 15, wherein said choke has a relative permeability in the range of 1,000-150,000

34. A system in accordance with claim 15, wherein a time-varying current output from said source comprises an alternating current.

35. A system in accordance with claim 15, wherein a time-varying current output from said source comprises an varying direct current.

36. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of a production tubing string for a well.

37. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of a pumping rod for a well.

38. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of a well casing for a well.

39. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of a production tubing string for a well and at least a portion of a well casing for said well.

40. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of at least one branch of a well.

41. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of an oil refinery piping network.

42. A system in accordance with claim 15, wherein said piping structure comprises at least a portion of above surface refinery production pipes.

43. A system in accordance with claim 15, wherein said electrical return comprises a well casing for a well.

44. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of an earthen ground.

45. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of a conductive fluid.

46. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of a packer.

47. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of another piping structure of a same well.

48. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of another piping structure of another well.

49. A system in accordance with claim 15, wherein said electrical return comprises at least a portion of an equipment part having an elongated bore containing at least a portion of said piping structure therein.

50. A system in accordance with claim 15, further comprising an electrical insulating barrier between said piping structure and at least a portion of said electrical return.

51. A system in accordance with claim 48, wherein said barrier comprises concrete.

52. A system in accordance with claim 48, wherein said barrier comprises a non-metallic material.

53. A system in accordance with claim 15, wherein said device comprises a control module adapted to control and communicate with at least one additional electronic component electrically connected thereto.

54. A system in accordance with claim 15, wherein said device comprises a transformer.

55. A system in accordance with claim 15, wherein said device comprises a battery.

56. A system in accordance with claim 15, wherein said device comprises multiple components electrically connected together.

57. A system in accordance with claim 15, wherein said device comprises an electrically controllable and electrically actuated valve.

58. A system in accordance with claim 15, wherein said device comprises an electrically controllable valve actuated by a low current electric motor.

59. A system in accordance with claim 15, wherein said device comprises a sensor for data acquisition.

60. A system in accordance with claim 15, wherein said device comprises a sensor and an electrically controllable valve to form a close loop system.

61. A system in accordance with claim 15, wherein said device comprises a tracer fluid and an electrically controllable release valve.

62. A system in accordance with claim 15, wherein said device comprises a power transformer adapted to supply power to said device, and a modem transformer adapted to provide communication signals for said device.

63. A system in accordance with claim 15, wherein said device comprises a testing probe.

64. A system in accordance with claim 15, further comprising:

an electrical insulator located at said first end of said piping structure, said insulator being between said piping structure and said electrical return such that said piping structure is electrically insulated from said electrical return along said first end.

65. A system in accordance with claim 62, wherein said insulator comprises an insulated hanger.

66. A system in accordance with claim 62, wherein said insulator comprises an insulated pipe section.

67. A system in accordance with claim 15, wherein at least a portion of said piping structure is substantially electrically isolated from the earth.

68. A system in accordance with claim 15, further comprising a computer system adapted to send and receive data to and from said device via said electric circuit.

69. A system for defining an electrical circuit, comprising:

a piping structure comprising a first location, a second location, and an electrically conductive portion extending from said first location to said second location;

two induction chokes, a first of said chokes being located about a portion of said piping structure along said first location, and a second of said chokes being located about a portion of said piping structure along said second location;

a source of time-varying current electrically connected to said electrically conductive portion of said piping structure at a location between said chokes;

a device comprising two terminals, said device terminals each being electrically connected to said electrically conductive portion of said piping structure such that said second choke is located along said piping structure between said electrical connection locations for said device terminals; and

an electrical return electrically connecting between said electrically conductive portion of said piping structure along said second location and said source to complete said electrical circuit, such that said electrical connection for one of said device terminals is between said electrical connection location along said piping structure for said electrical return and said choke.

70. A method of operating a well having a pipe disposed in the earth comprising the steps of:

providing an induction choke coupled to the pipe downhole and disposed in enveloping relationship to a portion of the pipe;

coupling time varying current to the pipe uphole relative to the choke;

inhibiting time varying current flow distal to the choke and developing a voltage potential across the choke;

coupling a device to the pipe proximate the choke; and

operating said device with said voltage potential to operate said well.

71. The method of claim ~~71~~ 70, including converting said voltage potential to direct current and operating said device coupled to the pip with said direct current.

72. The method of claim 71, including coupling multiple devices to said pipe and operating each device.

73. The method of claim 73, wherein a number of the devices are powered by the voltage potential developed across a single induction choke.

74. The method of claim 73, wherein a number of the devices are associated with a number of induction chokes and each device is powered by the voltage potential developed across the associated induction choke.

75. The method of claim 71, wherein the device is a controllable valve.

76. The method of claim 71, wherein the device is a sensor.

77. In a petroleum well having a piping structure embedded in an elongated borehole extending into the earth, the improvement comprising:

an induction choke configured for enveloping a portion of said piping structure and operable for developing a voltage potential on the piping structure on each side of the induction choke when a time-varying current is applied to the piping structure on one side of the induction choke.